Goodness-of-Fit and Linear Combinations in Logistic Distributions: Advances and Applications

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Abstract

We studied two significant advancements in the statistical analysis of logistic distributions. The first part focuses on the exact distribution of linear combinations of generalized logistic random variables, presenting a novel approach that employs Fox's H-function for precise numerical evaluation of probability density and cumulative distribution functions. This method demonstrates superior accuracy and computational efficiency, with applications in areas such as finance modeling. The second part introduces a goodness-of-fit test for multivariate logistic distributions. Utilizing characteristic functions and the radial Fourier transform expressed via the Hankel transform. This test exhibits enhanced power and reliability, particularly in high-dimensional contexts, outperforming traditional techniques like Fasano and Franceschini's modification of the multivariate Kolmogorov-Smirnov test. The practical utility of the test is showcased through applications to real-world data.